

Validating of Damage Evolution Models for Composite Materials

Tuesday August 14th

8:00 - 9:00 Badging and Continental Breakfast
9:00 – 9:20 Workshop Introduction (Chuck Farrar, LANL, Engineering Institute Director)
9:20 – 10:00 Overview of Industry Practice (Tentatively Ed White, Boeing)
10:00 – 10:30 Multi-Scale Modeling of Composite Material Damage (Todd Williams, LANL)
10:30 – 11:00 Break
11:00 – 11:30 Experimental Characterization of Composite Materials (Phil Rae, LANL)
11:30 – 12:00 Validation of Composite Models (Francois Hemez, LANL)
12:00 – 1:30 Working Lunch (Discussion of future directions for composite model validation)
1:30 – 3:00 Working Groups Discussions 1
3:00 – 3:30 Break
3:30 – 5:00 Working Groups Discussions 2
5:00 – 6:00 Working Group Discussion Group Leaders Meeting
6:30 – 9:00 Workshop Dinner

Wednesday, August 15th

8:00 - 8:30 Continental Breakfast
8:30 – 9:00 Wind Energy Applications (Mark Rumsey, Sandia National Lab))
9:00 – 9:30 Unmanned Aerial Vehicle Applications (John Kosmatka, UCSD)
9:30 – 10:00 Detection and location of damage in composites by wave propagation techniques (Francesco Lanza di Scalea, UCSD)
10:00 – 10:30 Break
10:30 – 11:00 Space Shuttle Applications (Tentatively Leigh Phoenix, Cornell)
11:00 – 11:30 Computational simulation of composite materials with random microstructure (Lori Graham-Brady, Johns Hopkins)
11:30 – 12:00 TBD
12:00 – 1:30 Working Lunch (Discussion of future directions for composite damage assessment)
1:30 – 3:00 Working Groups Discussions 3
3:00 – 3:30 Break
3:30 – 5:00 Working Groups Discussions 4
5:00 – 6:00 Working Group Discussion Group Leaders Meeting
6:30 – 9:00 Dinner (on your own, but we will help coordinate rides)

Thursday, August 16th

8:00 - 8:30 Continental Breakfast
8:30 – 9:00 Raman Spectroscopy for Composite Materials (Matt Lewis, LANL)
9:00 – 9:30 Modeling Fatigue Damage in Composites (Frank Abdi, Alpha-Star)
9:30 – 10:00 Working Group 1 final out-brief & discussion
10:00 – 10:30 Break
10:30 – 11:00 Working Group 2 final out-brief & discussion
11:00 – 11:30 Working Group 3 final out-brief & discussion
11:30 – 12:00 Working Group 4 final out-brief & discussion
12:00-12:30 Final Discussion and survey
12:30 Adjourn

Working Groups and Discussion Topics

Working Group 1: Multi-Scale Damage Modeling for Composite Materials

Discussion Group Leaders (Todd Williams and John Kosmatka)

Issues to be discussed and summarized:

- Summary of current modeling approaches in use by industry and in development by the research community,
- What are the types of damage accumulation that can be modeled (e.g. fracture, delamination, debond, creep, fatigue, etc.) What are the characteristic length and time scales associated with this damage accumulation and modeling?
- What is the ability to predict system level performance with such models.
- What are the weaknesses/limitations/uncertainties of such models?

Working Group 2: Experimental Characterization of Composite Material Properties

Discussion Group leaders (Phil Rae, Eric Brown, Dan Thoma)

Issues to be discussed and summarized:

- Summary of current experimental approaches to materials characterization in use by industry and in development by the research community.
- What properties are readily detectable with current technology? What properties are needed and currently difficult to identify?
- Where does uncertainty enter into the measurement process. Is this uncertainty quantifiable?

Working Group 3: Experimental Characterization of Damage in Deployed Systems

Discussion Group leaders (Mike Todd, Ed White)

Issues to be discussed and summarized:

- Current industry practices for assessing damage in deployed systems
- What are the uncertainties associated with such damage assessments. What damage can and cannot be detected? What limits the fidelity of these methods?
- What damage assessment methods are in the research and development stages and what shortcoming are they attempting to address?

Working Group 4: Verification and Validation Procedures

Discussion Group leaders (Francois Hemez, Dave Higdon)

Issues to be discussed and summarized:

- How do we define verification and validation for multi-scale composite damage models?
- Sources of uncertainty
- How are current material damage models verified and validated?
- How are system level model models verified and validated?

Group 1	Group 2	Group 3	Group 4
Gyuhae Park	Matt Bement	Trevor Tippetts	Cheng Liu
Frank Addressio	Jeff Hylock	Matt Lewis	D.J. Luscher
John Diennes	Mark Bourke	Partha Rangaswamy	Bart Benedikt
F. Lanza di Scalea	Joel Conte	Todd Griffin	Mark Rumsey
Doug Adolf	Daniel Hammerand	Josh Paquette	Leigh Phoenix
George Voyiadjis	Lori Graham	Ersan Ustandag	Stephanie TerMaath
Scott Case	Frank Abdi	Michael Wisnom	Hashem Mourad
Tom Gates	Jonathan White	<i>Kirsten McKay</i>	<i>Matt Nothnagel</i>
<i>Manny Gonzales</i>	<i>Joel Marquez</i>	<i>Jesse Oliver</i>	<i>Brett Nadler</i>
<i>Maurizio Gobbato</i>	<i>Jake Finkler</i>		

Group Rotations

Working Group Discussion 1, Tuesday August 14th 1:30 to 3:30

Group 1: Multi-Scale Damage Modeling for Composite Materials: Group 1

Group 2: Experimental Characterization of Composite Material Properties

Group 3: Experimental Characterization of Damage in Deployed Systems

Group 4: Verification and Validation Procedures

Working Group Discussion 2, Tuesday August 14th 3:30 to 5:00

Group 4: Multi-Scale Damage Modeling for Composite Materials

Group 1: Experimental Characterization of Composite Material Properties

Group 2: Experimental Characterization of Damage in Deployed Systems

Group 3: Verification and Validation Procedures

Working Group Discussion 3, Wednesday August 15th 1:30 to 3:30

Group 3: Multi-Scale Damage Modeling for Composite Materials

Group 4: Experimental Characterization of Composite Material Properties

Group 1: Experimental Characterization of Damage in Deployed Systems

Group 2: Verification and Validation Procedures

Working Group Discussion 4, Wednesday August 15th 3:30 to 5:00

Group 2: Multi-Scale Damage Modeling for Composite Materials

Group 3: Experimental Characterization of Composite Material Properties

Group 4: Experimental Characterization of Damage in Deployed Systems

Group 1: Verification and Validation Procedures